THE TREATMENT OF SELF-INJURIOUS ESCAPE BEHAVIOR USING INSTRUCTIONAL FADING WITH AND WITHOUT EXTINCTION

By

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Abstract of Dissertation Presented to the Graduate School
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THE TREATMENT OF SELF-INJURIOUS ESCAPE BEHAVIOR USING INSTRUCTIONAL FADING WITH AND WITHOUT EXTINCTION

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The self-injurious behavior (SIB) of three developmentally disabled individuals increased when a brief timeout was provided contingent on the behavior, indicating that their SIB was maintained by negative reinforcement in the form of escape from instructions. Based on these results, instructional fading was implemented as treatment for all three subjects. The procedure involved initially eliminating all instructions from sessions and subsequently increasing the rate of instructions gradually over time. During baseline, instructions were presented at the rate of 2 per minute, and escape was provided contingent on SIB. Treatment was implemented in a multiple baseline across subjects design and began with the rate of instructions at 0 per minute. If SIB remained below 0.5 per minute for two consecutive sessions, another instruction was added the following session. This continued until the baseline rate of instructions was reached. If SIB remained high for 10 consecutive sessions, indicating a lack of success with the instructional fading procedure, escape extinction was implemented. The extinction procedure involved preventing escape by providing physical guidance through the task.

Treatment was completed when the rate of instructions was the same as in baseline, and SIB remained below 0.5 per minute for two consecutive sessions.

Results showed that instructional fading without extinction was effective in initially reducing SIB, but decreases in SIB were not maintained. When the extinction component was added to the fading procedure, SIB was quickly suppressed for one subject but not for the other two. All three subjects required over 150 sessions to meet the treatment termination criteria. Subjects' history of intermittent escape may have been responsible for the prolonged course of treatment.

INTRODUCTION

Self-injurious behavior (SIB) has been defined as any behavior producing physical injury to an individual's own body (Tate & Baroff, 1966) and has been estimated to occur in 10% to 15% of the population residing in state facilities for the developmentally disabled (Griffin, Williams, Stark, Altmeyer, & Mason, 1984; Schroeder, Schroeder, Smith, & Dalldorf, 1978). Behavior problems such as SIB have often been cited as a factor contributing to institutionalization (Eyman, Borthwick, & Miller, 1981), and appear to be more prevalent among younger, more severely retarded residents who have been institutionalized longer (Schroeder et al., 1978). Common topographies of SIB include biting, head hitting, head banging, and scratching; however, eye gouging, hand mouthing, ruminating, hair pulling, and pica have also been observed in this population (Griffin et al., 1984).

Although some forms of SIB may be associated with medical conditions or physiological disorders (Cataldo & Harris, 1982), there is evidence that SIB is often a learned response maintained by specific reinforcement contingencies (Carr, 1977), which may be identified using a variety of assessment methods (see Iwata, Vollmer, & Zarcone, 1990, for a review). The most accurate method is to directly observe the occurrence of the behavior under experimental conditions. For example, Iwata, Dorsey, Slifer, Bauman, and Richman (1982) exposed subjects to a series of conditions designed to assess the effects of positive reinforcement, negative reinforcement, and automatic reinforcement on the frequency of SIB. Results showed that for six of nine subjects, SIB was noticeably higher

in one specific condition, which differed across individuals. These results indicated that there was a functional relationship between the reinforcement contingency manipulated and SIB. Once the behavioral function has been identified, treatment procedures can be developed based on directly manipulating the reinforcement contingency.

Several reinforcement contingencies can be identified through a functional analysis. For example, SIB may be maintained by automatic or sensory consequences directly produced by the behavior (Lovaas, Newsom, & Hickman, 1987; Skinner, 1969). Although there is ample evidence that sensory and perceptual events can function as reinforcement, there is very little empirical evidence showing the acquisition and maintenance of problem behavior by sensory consequences. This is primarily due to the difficulty in achieving external experimental control over the delivery of perceptual reinforcers (Lovaas et al., 1987). Self-injury also can be maintained by the social environment through positive or negative reinforcement. For many individuals, positive reinforcement in the form of social interaction or attention can serve as reinforcement for SIB. For example, Lovaas, Freitag, Gold, and Kassorla (1965) found that providing attention (e.g., saying "I don't think you are bad") contingent upon head and arm banging increased the frequency of a child's SIB. Finally, SIB can be maintained by negative reinforcement in the form of contingent removal, reduction, or postponement of stimulation (Hineline, 1977). Several studies have shown that SIB can be maintained by negative reinforcement in the form of escape from or avoidance of academic or work tasks (e.g., Iwata et al., 1982; Steege, Wacker, Berg, Cigrand, & Cooper, 1989). For example, Steege et al. (1989) presented academic tasks to a subject and prompted him to comply. If the subject engaged in SIB, a 20-s timeout from the task was provided. This procedure

resulted in an increase in SIB, indicating that a break from instructions served as negative reinforcement.

Behavior that has been acquired and maintained by escape requires the development of treatment approaches based on modifying the negative reinforcement contingency. Behavior maintained by escape differs significantly from behavior maintained by positive reinforcement because usually there is a discrete, antecedent event preceding the occurrence of the escape behavior (i.e., the presentation of aversive stimulation), as well as an observable consequence following the behavior (i.e., the termination of the stimulation). As a result, several treatment approaches have been developed that are based on modifying either the antecedents or consequences of escape.

In the first approach, antecedent events can be manipulated to decrease the likelihood that the escape behavior will occur. These events often function as establishing operations, which create the conditions that make escape reinforcing (Michael, 1982). One way the establishing operations of escape can be modified is through a process known as stimulus fading. Procedurally, stimulus fading involves decreasing escape behavior by modifying or eliminating the aversive events that evoke the behavior. Once the behavior has been eliminated or reduced, the aversive event can be gradually faded back to its initial level.

Stimulus fading has been used in a few studies with individuals who exhibit behavior maintained by escape from instructions. In a study by Weeks and Gaylord-Ross (1981), tasks were faded from easy to difficult across sessions and resulted in a decrease in SIB. However, decreasing trends across both baseline and treatment may indicate that an additional component to fading was in effect. Heidorn and Jensen (1984) also used a fading procedure that was based on modifying the number of tasks presented per session. If SIB decreased and remained low, the number of instructions presented per session was

gradually increased. However, there were several additional components used during treatment; thus, reductions in SIB may have been attributed to any one of several procedures.

In both of the above studies, modifying events antecedent to SIB resulted in immediate decreases in SIB. This effect can be particularly advantageous with individuals who exhibit severe forms of inappropriate behavior. It is important, however, that the antecedent events occasioning SIB are not simply eliminated from the individual's daily activity schedule. For individuals participating in habilitative programs, eliminating or greatly reducing instructional activities may result in a lack of progress toward long-term educational goals. By using a procedure such as fading, however, instructional activities can be eventually returned to their former level.

The second treatment approach to reduce escape behavior involves modifying its consequences. Research has shown that the treatment of behavior problems can be facilitated when the reinforcement contingency maintaining the behavior is eliminated through the process of extinction (e.g., Lovaas & Simmons, 1969; Mace, Page, Ivancic, & O'Brien, 1986). For behavior maintained by negative reinforcement, "escape" extinction involves two parts. First, aversive stimulation must be present to establish escape as reinforcement. Second, escape from the aversive stimulation must be prevented (Iwata, 1987).

Several studies have shown that escape extinction is effective in eliminating SIB maintained by escape from academic or physical tasks. For example, Repp, Felce, and Barton (1988) showed that presenting tasks at the rate of one per minute and continuing to verbally and physically prompt subjects to comply with the task resulted in a reduction in SIB and stereotypy maintained by negative reinforcement. In studies by Horner, Day,

Sprague, O'Brien, and Heathfield (1991) and Steege et al. (1989), extinction in the form of the continued presentation or redirection to a task was used to reduce escape-maintained SIB. Other studies have implemented extinction by providing physical guidance through a task contingent on SIB. For example, Iwata, Pace, Cowdery, Kalsher, and Cataldo (1990) presented seven subjects with academic or medically related tasks. If SIB occurred during a task, the subject was guided to complete the task. Finally, Sailor, Guess, Rutherford, and Baer (1968), developed a hierarchy of tasks based on difficulty and presented difficult tasks after each occurrence of tantrum behavior. In both the Iwata et al. and the Sailor et al. studies, however, extinction may not have been the only process involved. For some individuals, the contingent presentation of physical guidance or difficult tasks may have functioned as punishment of the target behavior.

Although escape extinction has been shown to be an effective means of eliminating escape behavior, several disadvantages are associated with its use. First, the procedure may occasion an increase or "burst" in responding when treatment is initially implemented (Iwata, Pace, Cowdery, Kalsher, & Cataldo, 1990; Repp et al. 1988). This can make extinction procedures for SIB or aggression difficult from a practical standpoint because an increase in the behavior can be dangerous to either the individual or to those in his or her environment. Second, extinction may result in an increase in the intensity or severity of the escape behavior. Third, other inappropriate escape behaviors may increase (e.g., aggression, destruction) when SIB is extinguished. For example, Goh and Iwata (in press) showed that when extinction was implemented with SIB, not only did SIB initially increase, but the frequency of aggression increased also. Finally, from a practical standpoint, extinction may be difficult to implement with some individuals. For example, a therapist may not be able to prevent escape when the subject is stronger than the therapist.

Thus, the therapeutic use of escape extinction may be practical only under certain circumstances.

Recent studies have examined the separate and combined effects of stimulus fading and extinction as treatment for escape behavior. Pace, Iwata, Cowdery, Andree, and McIntyre (1993) faded the frequency of task presentation using instructional fading. The procedure involved initially removing all instructions from treatment sessions, and if SIB remained low, increasing the rate of instructions over sessions until the original baseline instructional rate was reached. In addition to the fading procedure, escape extinction was implemented when SIB occurred during an instructional trial (i.e., the subject was physically guided through the task). Results showed immediate reductions in SIB (i.e., there was no extinction burst) that were maintained throughout treatment. It is not clear, however, which component of treatment reduced behavior because the separate effects of extinction and fading were not completely assessed. Although extinction alone was briefly examined with one subject, the condition was discontinued after 16 sessions because SIB did not decrease. It is possible, however, that if the extinction condition was continued, SIB may have decreased within fewer sessions than when extinction was combined with fading.

Zarcone et al. (in press) extended the Pace et al. study by comparing the therapeutic effects of escape extinction with and without instructional fading. Results showed that for two subjects the end of treatment criterion was reached in fewer sessions when extinction was implemented alone than when extinction was combined with fading. Specifically, treatment was completed for one subject within 9 sessions with extinction alone; treatment was completed in the extinction plus fading condition within 34 sessions, even when the rate of fading was accelerated. The second subject completed treatment with extinction alone in 21 sessions and extinction plus fading in 54 sessions. Although treatment was completed within fewer sessions with extinction, there was a burst in responding at the

outset of treatment with extinction, which was not observed when extinction was combined with fading.

Although previous research has shown that both extinction and extinction plus fading are effective treatment procedures for escape-maintained SIB (e.g., Iwata, Pace, Cowdery, Kalsher, & Cataldo, 1990; Pace et al., 1993; Zarcone et al., in press), the effects of fading without extinction have yet to be clearly assessed. Presumably, this antecedent-only approach would initially eliminate SIB at the outset of treatment, but without extinction in effect any behavior that occurs would necessarily be reinforced with escape. Thus, there are three possible therapeutic outcomes if fading were implemented alone. First, the procedure may be effective in reducing SIB quickly and maintaining it at a low level. Second, the procedure may be ineffective in reducing SIB because the behavior does not decrease. Finally, fading may initially be effective in decreasing SIB, but as the rate of instructions increases, the probability that SIB will occur will also increase due to continued negative reinforcement.

The purpose of the present study was to identify individuals who exhibited SIB maintained by escape from or avoidance of instructions. This was accomplished by conducting a functional analysis of each subject's SIB. Those individuals identified with escape-maintained SIB participated in an assessment of the effects of instructional fading as the sole intervention in the treatment of SIB.

METHOD

Subjects and Setting

Three individuals residing in a state facility for the developmentally disabled participated. All three individuals were diagnosed with profound mental retardation and were chosen to participate in this study because they exhibited SIB at a high frequency. In addition, their SIB was maintained by escape from instructions (see functional analysis conditions below).

Kate was an ambulatory 27-year-old woman whose SIB consisted of hitting her face with her palm or fist. She also exhibited a number of self-stimulatory behaviors such as body rocking, turning in circles, and pushing chairs in circles. Her sensory impairments included blindness from cataracts and profound hearing loss. She had limited self-care and feeding skills and was not toilet trained. Kate could follow a few simple instructions, but had no expressive language skills. Her SIB significantly interfered with the training she received at her residence and worksite. During the course of the study she did not receive any psychotropic medication.

Jack was an ambulatory 38-year-old male whose SIB consisted of banging his head against hard surfaces and biting his hand. He did not have any sensory impairments. Jack wore a helmet throughout the day due to seizures and poor balance, which placed him at risk for falling. His self-care skills were limited due to lack of motor skills; he required assistance in bathing and dressing, but he could feed himself and signal when he needed to be assisted to the bathroom. Although Jack could follow a number of one-step

instructions, his expressive language consisted of a single word ("No"), which he would utter when demands were placed on him. Staff on Jack's residence noted that his SIB was most severe when he was required to ambulate and that it interfered with daily training and leisure activities. Throughout the study, Jack received low doses of Dilantin to control seizures.

Jesse was an ambulatory 40-year-old male whose SIB consisted of slapping the side of his face, banging his head against hard surfaces, punching his sides, and hitting his hands and arms against hard surfaces. Jesse exhibited additional behavior problems such as aggression and spitting. He was toilet trained, able to feed himself, and perform most self-care skills, except toothbrushing and bathing, without physical assistance. Jesse had no sensory impairments. Although his expressive language skills consisted of only a few echolaliac words, his receptive language skills were very good; he could follow many complex instructions. Jesse often assisted staff on his home cottage in activities such as mopping the floor, setting the table, and cleaning food trays; however, staff reported that if he was working on a task and became "upset," they would give him a break from the activity. During the course of the study, he received several medications: Dilantin for seizures, and Sinequan (an antidepressant) and Mellaril (an antipsychotic) for behavior problems. The dosages for each medication remained constant throughout the study.

The study was conducted on the grounds of the facility at a day program for the assessment and treatment of SIB. Three to five daily sessions were conducted with each subject, four to five days a week. Sessions lasted for 15 minutes, separated by 10- to 15-minute breaks. Therapy rooms were either 3.7 by 5.7 m or 6.8 by 12.5 m and contained chairs and appropriate materials for each session. Jack did not wear his protective helmet during assessment or treatment sessions; however, the wall directly behind his chair was

padded. Sessions were terminated and all responses blocked if subjects engaged in any behavior producing an open injury. An experimenter, and when necessary an assistant, and one or two data collectors were present during all sessions.

Response Measurement and Reliability

Self-injurious responses were defined as follows: hitting (Kate and Jesse)--contact of any part of the hand or arm with any part of the head, body, or any hard surface such as a wall or table; head banging (Jack and Jesse)--contact of any part of the head with a hard surface; hand biting (Jack)--closure of the teeth on any part of the skin from fingertips to wrist. Data were also collected on the number of instructions presented by the experimenter. During each session, an observer recorded data on a hand-held computer (Assistant, Model AST 102) during continuous 10-s intervals. Session data were converted to responses per minute for SIB and instructions.

Interobserver agreement was assessed by having a second observer simultaneously but independently collect data during 59.9% of all assessment sessions, 57.4% of all baseline sessions, and 43.1% of all treatment sessions. Agreement percentages were calculated based on an interval-by-interval comparison of observers' records, in which the smaller number of responses in each interval was divided by the larger number of responses. These fractions were then summed across all intervals, divided by the total number of intervals in the session, and multiplied by 100 to get the percentage agreement between the two observers. Mean agreement percentages for SIB during assessment, baseline, and treatment for all three subjects are listed in Table 1.

Experimental Sequence and Designs

The first phase of the study consisted of a functional analysis baseline, in which a series of conditions was presented in a multielement format (i.e., conditions were presented

Table 1

Percentage of Assessment, Baseline, and Treatment Sessions with Interobserver Agreement and Mean Agreement Percentages for SIB

	Assessment	Baseline	Treatment
Percentage of Sessions with Interobserver Agreement			
Kate	66.7	50.0	35.8
Jack	66.7	55.5	62.5
Jesse	46.2	66.7	31.1
Mean Agreement Percentages (range)			
Kate	99.3 (97.7-100)	93.2 (92.6-93.7)	96.6 (83.9-100)
Jack	97.5 (94.0-100)	96.5 (89.8-99.4)	99.2 (95.0-100)
Jesse	98.2 (88.9-100)	96.6 (91.3-98.8)	97.5 (88.0-100)

each day in random order) (Sidman, 1960; Ulman & Sulzer-Azaroff, 1975). The purpose of this analysis was to identify the variables maintaining each subject's SIB. Baseline conditions were then initiated with all three subjects. Treatment was introduced in a multiple baseline across subjects design.

Functional Analysis Conditions

Subjects were exposed to four assessment conditions based on those described by Iwata et al. (1982).

Attention

This condition was designed to assess the effects of positive reinforcement (i.e., adult attention) on the rate of SIB. The subject was placed in a therapy room with a variety of toys and materials available. At the beginning of each session, the experimenter entered the room and told the subject: "I will be here if you need me." The experimenter then sat away from the subject and did not make any eye contact. Contingent on SIB, the experimenter immediately approached the subject and delivered attention in the form of concern and disapproval of the behavior (e.g., "Stop that, you'll hurt yourself."), and physical contact (e.g., touching the subject's shoulder). All other behaviors were ignored by the experimenter.

Demand

This condition was designed to assess the effects of negative reinforcement (i.e., escape from or avoidance of instructions) on the rate of SIB. The experimenter either sat across the table from or stood in front of the subject and presented tasks on a fixed time 30-s schedule (FT 30-s). The tasks used in this and all subsequent instructional conditions were similar to those found in the subject's educational or habilitation plan. If the subject did not comply with the instruction, the experimenter demonstrated the correct response

and physically guided the response if necessary. Praise, clapping, and pats on the back were consequences for compliance. If the subject exhibited SIB during any part of the instructional sequence, the experimenter terminated the task (i.e., removed the materials and turned/walked away). The next instruction was presented according to schedule.

Alone

This condition was designed to assess the effects of automatic or sensory reinforcement on the rate of SIB. The therapy room was arranged to approximate a "barren" environment without any external forms of reinforcement, such as toys, materials, or attending adults. The subject was placed in the therapy room alone, with only an observer present to collect data. There was no interaction with the subject during these sessions.

Play

This condition served as a control for the other three conditions. In this condition, the therapy room was made to simulate an "enriched" environment. During sessions, the experimenter provided attention to the subject, and play materials were made available. The experimenter did not give any instructions during this condition. At the beginning of each session, the experimenter entered the room and directed the subject to the materials. The experimenter attended to the subject on a FT 30-s schedule. The attention consisted of either presenting an item to the subject or providing verbal interaction (e.g., "you look nice today"). Any SIB that occurred during this session was ignored by the experimenter.

Treatment Conditions

Baseline

Procedures in effect during baseline were identical to those in the Demand condition: the experimenter presented tasks, provided social praise contingent on compliance, and terminated the trial contingent on the occurrence of SIB.

Tasks chosen to be used during baseline and treatment were associated with high rates of SIB during the functional analysis. Specific tasks varied from subject to subject, but generally they included gross motor and self-care tasks, such as "stand up," "sweep the floor," and "comb your hair."

Instructional Fading

This procedure consisted of eliminating all instructions from the initial session of treatment and gradually fading the instructions back into sessions over time. The number of instructions per session was increased by one if the subject's SIB was at or below 0.5 responses per minute for two consecutive sessions. Consequences for SIB were the same as during baseline; that is, SIB produced termination of the trial. Treatment was completed when the rate of instructions was the same as in baseline (i.e., 2 instructions per minute or 30 instructions per session) and the subject's rate of SIB remained below 0.5 per minute for two consecutive sessions.

Instructional Fading plus Escape Extinction

If the subject's rate of SIB did not decrease in the fading condition (i.e., after ten consecutive sessions without meeting the criterion of 2 consecutive sessions with SIB below 0.5 responses per minute) an escape extinction component was added to treatment. Thus, contingent on the occurrence of SIB during a trial, the subject was not allowed to escape (i.e., he or she was physically guided through the task). The extinction component was withdrawn when subjects had two consecutive sessions with SIB at a rate below 0.5 responses per minute.

RESULTS

Functional Analysis Assessment

Assessment results are shown in Figures 1, 2, and 3. Figure 1 shows the results of Kate's functional analysis. Highest rates of SIB occurred in the Demand condition (M = 3.3 responses per minute). Kate exhibited very little SIB in the other three conditions (mean rate for Attention, Alone, and Play conditions combined = 0.1 responses per minute). Kate's functional analysis was the briefest of all three subjects; it lasted 9 sessions. Results indicated that Kate's SIB was clearly maintained by negative reinforcement in the form of escape from instructions.

Figure 2 shows the results of Jack's functional analysis, which were similar to those obtained with Kate. The highest rate of SIB occurred in the Demand condition (M = 3.1 responses per minute) and very little SIB occurred in the other three conditions (M = 0.1 responses per minute). Jeff's functional analysis also indicated that his SIB was maintained by escape from instructions.

Figure 3 shows the results of Jesse's functional analysis. His analysis was less clear than Kate's and Jack's for two reasons. First, some SIB occurred in at least one session of each condition, increasing the overall mean in the Attention, Alone, and Play conditions (combined mean = 0.92 responses per minute). Second, there was a low rate of SIB in one Demand session. Overall, however, the highest rates of SIB occurred in the Demand condition (M = 2.2 responses per minute), indicating that his SIB was primarily maintained by escape from instructions.

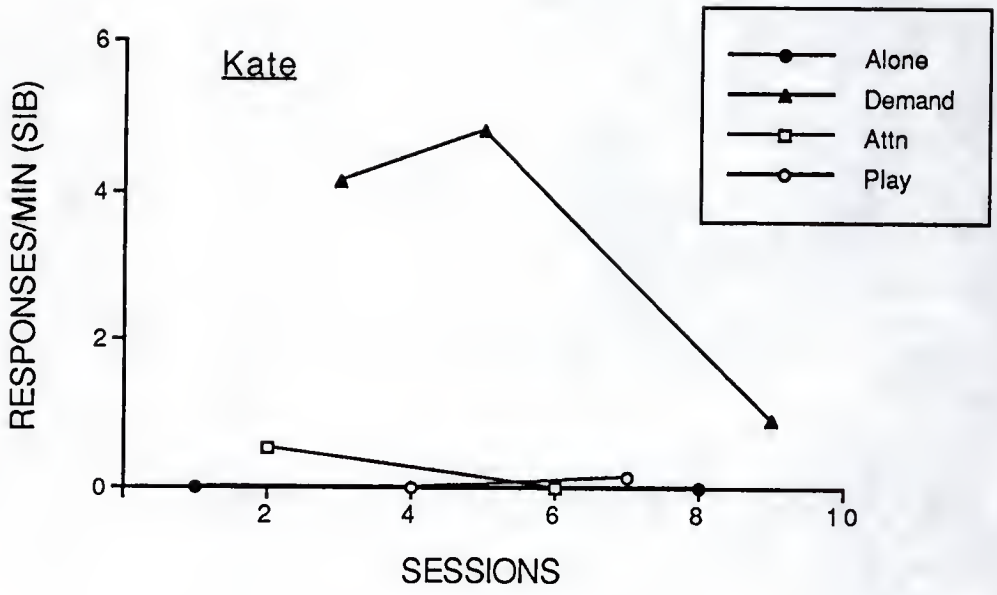


Figure 1. Responses per minute of SIB across assessment conditions for Kate.

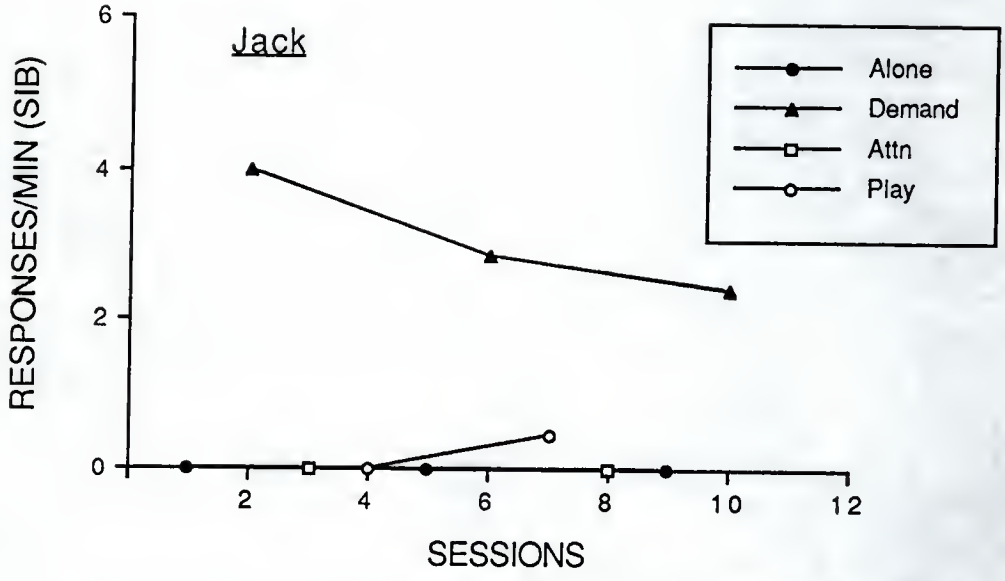


Figure 2. Responses per minute of SIB across assessment conditions for Jack.

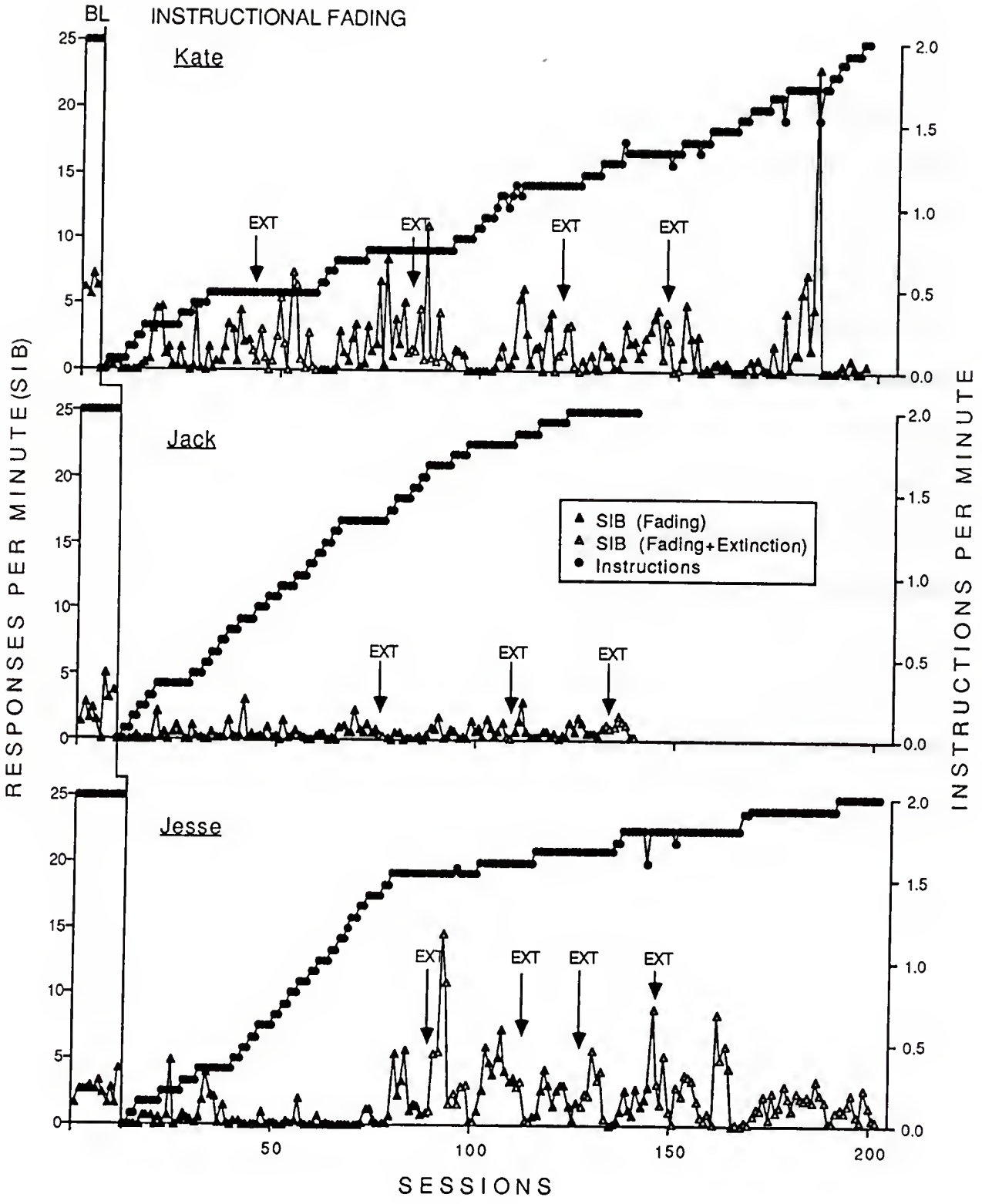
Figure 3. Responses per minute of SIB across assessment conditions for Jesse.

Treatment Evaluation

Figure 4 shows the results of baseline and treatment for all three subjects. Kate's data (upper panel) show a high rate of SIB during baseline (M = 6.4 responses per minute). When instructional fading was introduced, Kate's SIB decreased immediately to zero. As the rate of instructions increased, her rate of SIB increased and became more variable. At the rate of 0.5 instructions per minute (7 per session) there were 10 consecutive sessions with a high rate if SIB. Extinction was then added to the fading procedure. After 17 sessions with fading plus extinction, Kate had two consecutive sessions with SIB below 0.5 responses per minute; thus meeting the criterion to withdraw extinction and increase the instructional rate. Her rate of SIB under the fading procedure increased again at 11, 17, and 20 instructions per session, resulting in the addition of extinction a total of four times. Each time extinction was introduced, SIB decreased, and the extinction component was withdrawn. Kate completed treatment after 194 sessions.

Jack's data (middle panel) show a variable rate of SIB during baseline. His mean rate of SIB during baseline was 2.3 responses per minute, which nearly matched the rate of instructions (2 per minute). When treatment was implemented, Jack's SIB immediately decreased to zero for several sessions, and the rate of instructions was increased rapidly. At the rate of 1.33 instructions per minute (20 per session), he had a high rate of SIB for 10 consecutive sessions, and extinction was added to the fading procedure. Jack's SIB decreased below 0.5 per minute immediately; thus, after two sessions with extinction in effect, the component was withdrawn and the instructional rate increased by one. Extinction was introduced again at 1.8 instructions per minute (27 per session) and at

Figure 4. Responses per minute of SIB (left axis) and instructional trials per minute (right axis) during baseline and treatment for Kate, Jack, and Jesse. Arrows indicate when the extinction component was added to treatment.


BL
INSTRUCTIONAL FADING
Kate
Jack
Jesse
EXT
SIB (Fading)
SIB (Fading+Extinction)
Instructions
RESPONSES PER MINUTE(SIB)
INSTRUCTIONS PER MINUTE
SESSIONS
0
5
10
15
20
25
0.0
0.5
1.0
1.5
2.0
50
100
150
200

2.0 instructions per minute (30 per session). Each time extinction was introduced, his SIB quickly decreased. Treatment was completed after 129 sessions.

Jesse's data (lower panel) during baseline showed a fairly stable rate of SIB across 11 sessions. His mean rate of SIB during baseline was 2.6 responses per minute. The fading procedure appeared to be very effective in reducing Jesse's SIB at the outset of treatment; his rate of SIB remained very low, and instructions increased rapidly. At the instruction rate of 1.53 per minute (23 per session), Jesse's SIB increased noticeably and extinction was added to the fading procedure. His SIB continued to remain high with extinction in effect for 10 sessions, at which point it decreased for two consecutive sessions. When extinction was withdrawn and the instruction rate again increased, Jesse's SIB increased immediately. In fact, from this point on during treatment, each time the instruction rate increased, his SIB increased, requiring the reintroduction of extinction. Thus, it appeared that fading alone was not effective. When extinction was implemented the fourth time, it remained in effect until Jesse completed treatment. Even with extinction in effect, however, there were 56 additional sessions before treatment termination criteria were met. Treatment was finally completed for Jesse after 190 sessions.

DISCUSSION

Results of the present study are consistent with previous research indicating that reducing the frequency of instructions produces rapid reductions in SIB at the outset of treatment (Pace et al., 1993; Zarcone et al., in press). However, unlike the results of previous studies, reductions in SIB were not maintained as treatment progressed. In the present study, the increase in instructions increased the probability that SIB would occur, and without extinction in effect, SIB continued to be reinforced. These results show that without extinction, fading alone was ineffective in maintaining low rates of SIB.

Results of the present study also differed from previous research in terms of the length of treatment. In the Pace et al. (1992) study, treatment lasted approximately 100, 80, and 60 sessions when fading was used with extinction. However, no specific criteria were used to fade the frequency of instructions or to terminate treatment; thus, it is possible that treatment could have been completed within even fewer sessions. For the two subjects who completed the fading plus extinction condition in the Zarcone et al. (in press) study, the treatment termination criterion was met within approximately 30 - 50 sessions. In the present study, it took many more sessions for therapeutic effects to be obtained; over 140 sessions for Jack, and almost 200 sessions for Kate and Jesse. Although the fading criteria were somewhat more conservative in the present study than in Zarcone et al., the length of treatment doubled or even tripled that of the other studies. The primary difference in the present study that may have prolonged the course of treatment was the absence of a continuous extinction component.

When extinction was added to treatment, the behavior reducing effects varied across subjects. Jack's SIB decreased immediately (i.e., within two sessions) the first two times extinction was implemented and within 8 sessions the third time it was implemented, indicating that extinction was effective in reducing his behavior quickly. For Kate, fewer sessions with extinction were required across successive applications. Specifically, SIB decreased within 17 sessions during the first application, and within 12, 7, and 5 sessions during the second, third, and fourth applications, respectively. These results indicate that for Kate, extinction may have become more effective in suppressing SIB each time it was introduced even though the instructional rate had increased between applications. These data are consistent with other research indicating that with each exposure to extinction following reinforcement, behavior may decrease more quickly (Clark, 1964; Clark & Taylor, 1960). Finally, the rapidity of reduction in Jesse's SIB when extinction was implemented varied across successive applications. When extinction was added to the fading procedure, Jesse's SIB decreased within 12 sessions, 4 sessions, 7 sessions, 22 sessions, 23 sessions, and 11 sessions. Although previous research has indicated that extinction has fairly rapid behavior reducing effects (e.g., Iwata, Pace, Cowdery, Kalsher, & Cataldo, 1990; Zarcone et al., in press), extinction was in effect throughout treatment in both studies. In the present study, the effects of an intermittent history of escape available and unavailable may have resulted in the variation in treatment effects each time Jesse was exposed to extinction.

Although it appears that instructional fading alone may not be a desirable form of treatment, there are several advantages to implementing fading in conjunction with extinction. First, behavior is reduced immediately at the outset of treatment. For people who engage in severe topographies of SIB, a rapid reduction in behavior may be necessary

to reduce the risk of injury to the individual. In addition, side effects associated with the use of extinction alone (e.g., an extinction burst) may be eliminated.

There is one significant disadvantage when using fading or escape extinction: the procedures reduce SIB by eliminating reinforcement or the events that establish escape as reinforcement without providing reinforcement (positive or negative) for alternative behaviors. Research on establishing alternative escape responses using procedures such as "functional communication training" has indicated that teaching individuals with SIB to request assistance or a break from training is an effective means of reducing SIB (e.g., Carr & Durand, 1985; Steege et al., 1990; Wacker et al., 1990). In addition, positive reinforcement (e.g., praise) has been used to establish or maintain alternative behaviors such as compliance. Recent studies manipulating the sequence of instructions have indicated that compliant behavior can be increased by presenting a series of instructions for which there is a high-probability of compliance immediately before the presentation of an instruction for which there is a low probability of compliance (Davis, Brady, Williams, & Hamilton, 1992; Mace et al., 1988; Horner et al., 1991). This procedure has been shown to increase compliance, and when used in conjunction with extinction may also decrease inappropriate escape behavior (e.g., Zarcone, Iwata, Hughes, & Vollmer, 1993).

Future research using fading procedures may focus on developing methods for identifying the aversive event(s) establishing escape as reinforcement and developing treatment approaches based on fading some dimension of the event. In addition to the frequency of task presentation, several other dimensions of an instructional context can be used as the basis for fading. For example, several studies have described assessment conditions comparing easy versus difficult tasks and found that SIB was higher when difficult tasks were presented (e.g., Mace et al., 1986; Weeks & Gaylord-Ross, 1981).

The difficulty of an instruction could be manipulated in several ways such as the duration or the complexity of the task. In addition, tasks can be identified that have either a high-probability or a low-probability of compliance (e.g., Mace et al., 1988) and fading could occur along the dimension of probability of compliance. Finally, tasks could be faded across multiple dimensions (e.g., difficulty and frequency). Instructional contexts have several additional components that may occasion escape behavior including the work materials, therapist, prompting sequence, or physical guidance. Although fading along these dimensions may be somewhat more complex, it is possible to fade in the presence of the work materials or therapist, or the frequency of prompts or physical guidance.

Finally, other sources of aversive stimulation beside instructional situations may be amenable to fading, such as crowded or noisy conditions. McAfee (1987) showed that increasing the density of children in a classroom resulted in an increase in aggressive behavior with two subjects. Although environmental manipulations can limit the frequency with which these events occur (e.g., minimizing ambient noise and reducing the size of client groups), it may be beneficial to implement fading procedures to aid in eliminating inappropriate behavior under these circumstances. Establishing appropriate forms of escape behavior when the above sources of stimulation are present would also be beneficial.

Stimulus fading procedures have been used as a basis for treating clinical phobias. However, treatment usually involves the reduction of unobservable responses (e.g., fearfulness, anxiety) that are elicited by an aversive stimulus. These behaviors are often measured using verbal reports of levels of anxiety or fear (e.g., Kirsch & Henry, 1977; Ramirez & Kratochwill, 1990; Wolpe & Lang, 1964). For example, procedures such as systematic desensitization involve "imagining" the aversive stimulus or event while

engaging in a behavior incompatible with the escape response (Paul, 1967; Wolpe, 1958). Although desensitization procedures have reportedly been one of the most effective means of treating phobias (Mathews, 1978), there is no observable behavior available to directly measure the effects of therapy. A similar procedure often used in the treatment of phobias is graduated exposure therapy, which involves brief, in vivo exposures to the aversive stimulus (Weidner, 1970). This procedure is most like stimulus fading because a hierarchy of aversive stimuli is usually identified and exposure to these stimuli is faded from least to most aversive over time. The effects of therapy are also often assessed using unobservable changes in the client's reported level of anxiety or fear (Mathews, 1978).

In the present study, the effects of fading were directly assessed using a clearly defined response (i.e., SIB) as the dependent variable. If a directly observable response was established to indicate anxiety or level of aversiveness for individuals with phobias, the effects of therapy could be assessed more reliably. A few studies have attempted to use behavioral measures of the effects of in vivo exposure therapy. For example, D'Zurilla, Wilson, and Nelson (1973) measured the effects of several treatment procedures on subjects' fear of dead rats using an avoidance test among other measures before and after treatment. This test involved presenting several different dead rats to the subjects and giving points every time the subjects looked at, touched, or held a rat. Although these responses were not specifically escape responses terminating the presentation of the rats, approach behavior is functionally the opposite of avoidance or escape behavior, and measuring approach may allow a more empirical assessment of the effects of treatment. This approach could be used in a manner similar to communication training. For example, the subject can only escape from the testing area or end the presentation of the event by engaging in an alternative escape response (e.g., touching the stimulus). The amount of

time the individual must engage in the alternative behavior could be faded across sessions. Other empirical measures of the effects of exposure therapy could involve the use of negative reinforcement (e.g., a break) when a subject tolerates exposure to the aversive stimulus. The criterion for escape could then be faded across sessions.

In conclusion, although there are still many dimensions of stimulus fading that merit further research, this study has shown that fading without extinction will not maintain reductions in behavior. Further research on manipulating other dimensions of the instructional sequence or applying fading procedures to other behavior disorders, however, is clearly warranted.

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BIOGRAPHICAL SKETCH

Jennifer R. Zarcone attended Florida State University and the University of Florida as an undergraduate. As a major in psychology, she was required to take a number of courses in all areas of psychology. After taking several courses in behavior analysis, she decided that she wanted to do graduate work in the field of applied behavior analysis. She applied to the graduate program in the experimental analysis of behavior and was accepted into the program for fall of 1986.

As a graduate student, she has conducted research with developmentally disabled individuals who exhibit self-injurious behavior. Throughout graduate school she has been a research assistant at the Center for Self-Injury under the direction of her advisor, Brian Iwata. Currently, she is assisting Dr. Iwata in developing an outpatient clinic to provide assistance to families in the community with self-injurious children. In addition to the assessment and treatment of self-injury, she is also interested in conducting behavioral research in educational settings.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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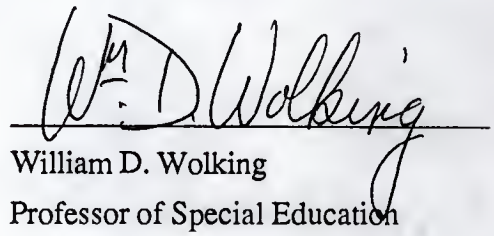

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